UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 7
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

SEP 09 2011

MEMORANDUM

SUBJECT: Screening Level Assessment of Potential Human Health Risks
Electrolux Home Products, Inc.
Jefferson, Iowa

FROM: Todd Phillips
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Todd a. Phillips

TO: Cynthia Hutchison
AWMD/RCAP

As requested, we have conducted a screening level assessment of potential human health risks for the soil and groundwater contamination at the Electrolux Home Products, Inc. (Electrolux) site in Jefferson, Iowa. This screening level risk assessment consisted of a review of available soil and groundwater data submitted by Golder Associates, on behalf of Electrolux, to the Iowa Department of Natural Resources (IDNR) (Golder Associates, 2011), a comparison of site data to risk-based screening levels, and an uncertainty analysis. Below, we have provided a summary of our assessment and conclusions. Also, please note that this is a qualitative assessment where potential health risks were not quantified.

Site Description and Background

The site was developed in 1960 by Electrolux's predecessor, White Consolidated Industries, to manufacture dishwasher motor transmissions. Historical activities at the site included machining, heat treating, degreasing, metal fabrication, powder coating, warehousing, and testing of washing machine transmissions. Electrolux closed the plant in March 2011 and has since decommissioned and removed the manufacturing equipment from the site buildings. The building is currently vacant and scheduled for demolition later this year (Golder Associates, 2011).

During Electrolux's operation of the site, five underground storage tanks (USTs) were used to store petroleum products, including cooling oil, used oil, and hydraulic oil. All five USTs were removed and/or closed by Electrolux in the late 1980s and 1990. Electrolux received a No Further Action letter from the IDNR regarding the UST removal activities performed in 1990 (Golder Associates, 2011).

The Electrolux facility also had two former aboveground degreasers and one solvent aboveground storage tank (AST). The solvent AST was located in a small building on the western side of the main site building. Additionally, multiple machine pits and trenches exist within the former manufacturing area (Golder Associates, 2011).

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Properties located immediately adjacent to the site include agricultural fields to the north and east, railroad tracks and agricultural fields to the south, and a railroad spur servicing a feed grain company located north of the site and residential properties to the west (Figure 1 from Golder Associates, 2011).

Sampling Results

Soil Data

In November 2010, ten soil borings (designated MW-1 through MW-9 and GP-01) were advanced on the site at the locations shown in Figure 2 (from Golder Associates, 2011). Soil boring GP-01 was advanced to an approximate depth of 30 feet below ground surface (bgs) to develop a lithologic profile, and borings MW-1 through MW-9 were advanced to depths ranging from 9 to 15 feet bgs for monitoring well installation (Golder Associates, 2011).

Composite soil samples from each 5-foot sample interval were collected from MW-1 through MW-9. GP-01 was abandoned following lithologic description. Soil samples were field screened for the presence of volatile organic compounds (VOCs) using a photoionization detector (Golder Associates, 2011). The VOCs were not detected in any soil samples; therefore, soil samples from MW-1 through MW-9 were not submitted for laboratory analysis.

In March 2011, 15 additional soil borings (designated MW-10 through MW-23 and MW-21A) were advanced to depths ranging from 8.4 to 14.5 feet bgs for monitoring well installation on the site at locations shown in Figure 2. One soil sample was collected, just above the water table, from each boring along the southern manufacturing boundary (MW-10 through MW-14) for laboratory analysis. Continuous soil samples were collected for laboratory analysis from each boring adjacent to the site building (approximately five soil samples per boring: MW-15 through MW-23 and MW-21A). Soil samples were analyzed for the VOCs, Total Extractable Petroleum Hydrocarbons (TEH), Total Petroleum Hydrocarbons (TPH) gasoline, oil and grease, and eight Resource Conservation and Recovery Act (RCRA) metals (Golder Associates, 2011). Also, one soil sample from borings MW-15 through MW-23 and MW-21A was analyzed for polychlorinated biphenyls (PCBs).

Soil contamination was detected just south of and at the southeastern corner of the manufacturing building (i.e., MW-15 through MW-23 and MW-21A). Maximum concentrations of chemicals that exceeded residential soil Regional Screening Levels (RSLs) are shown in Table 1. Although the RSLs are not available for the TEH, the TPH-gasoline, and oil and grease, maximum concentrations of these compounds are included in Table 1. The PCBs were not detected in any of the analyzed soil samples at concentrations above the laboratory reporting limits, and the RCRA metals were detected at concentrations consistent with naturally-occurring background concentrations.

Table 1. Maximum Soil Sample Results Detected at Electrolux

Chemical[1]	Sample Location	Maximum Concentration[2] (mg/kg)
1,1,2,2-Tetrachloroethane	MW-21A	1.64
1,2,3-Trichloropropane	MW-17	0.0978
1,2,4-Trimethylbenzene	MW-21A	14.6
Tetrachloroethylene	MW-19	0.214
Trichloroethylene	MW-19	159
Total Extractable Petroleum Hydrocarbons (TEH)[3]	MW-21	19,700
TPH as Gasoline[4]	MW-21A	181
Oil and Grease[5]	MW-21	19,000

[1]Only those chemicals with a maximum concentration that exceeded the resident soil RSL (USEPA, 2011a) were included in this table. To account for potential additive non-cancer health effects, non-cancer RSLs were adjusted to a hazard index (HI) of 0.1. However, maximum concentrations of the TEH, the TPH as Gasoline, and Oil and Grease were included because no RSLs are available.
[2]Maximum concentration of chemical is for soil sample collected in the 2 to 10 feet bgs range.
[3]Iowa OA-2 Analytical Method.
[4]Iowa OA-1 Analytical Method.
[5]Analytical Method SW9071B.

Groundwater Data

Monitoring wells were installed in soil borings MW-1 through MW-9 in November 2010 and in soil borings MW-10 through MW-23 in March 2011 (Golder Associates, 2011). Groundwater samples were collected from monitoring wells located along the southern manufacturing boundary (MW-5, MW-6, MW-7, and MW-9) as well as just south of and at the southeastern corner of the manufacturing building (MW-11 through MW-13 and MW-15 through MW-23). MW-10 and MW-14 were not sampled due to ponded water over the wells. Groundwater samples were analyzed for the VOCs and the TEH. Also, one groundwater sample from MW-21 was analyzed for the PCBs.

Groundwater contamination was detected just south of and at the southeastern corner of the manufacturing building (i.e., MW-15 through MW-23). Maximum concentrations of chemicals that exceed the RSLs for tapwater are shown in Table 2. Although RSLs are not available for the TEH, maximum concentrations are included in Table 2. The PCBs were not detected in the groundwater sample collected from MW-21 at concentrations above the laboratory reporting limits.

Table 2. Maximum Groundwater Sample Results Detected at Electrolux

Chemical	Sample Location	Maximum Concentration (µg/L)
1,1,1-Trichloroethane	MW-19	4,590
1,1,2-Trichloroethane	MW-19	35.1
1,1-Dichloroethane	MW-22	292
1,1-Dichloroethylene	MW-19	3,750
1,2,4-Trimethylbenzene	MW-21	285
1,2-Dichloroethane	MW-19	8.91
1,3,5-Trimethylbenzene	MW-21	104
Benzene	MW-19	1.76
Chloroform	MW-19	4.03
cis-1,2-Dichloroethylene	MW-19	120
Ethylbenzene	MW-19	33.0
Naphthalene	MW-21	38.4
Tetrachloroethylene	MW-19	548
Trichloroethylene	MW-19	189,000
Vinyl chloride	MW-22	3.64
Xylenes	MW-21	226
Total Extractable Petroleum Hydrocarbons (TEH)[2]	MW-21	119,000

[1]Only those chemicals with a maximum concentration that exceeded the Tapwater Regional RSL (USEPA, 2011a) were included in this table. To account for potential additive non-cancer health effects, non-cancer RSLs were adjusted to a hazard index (HI) of 0.1. However, the maximum concentration of TEH was included because no RSLs are available.
[2]Iowa OA-2 Analytical Method.

Exposure Pathways

Due to the commercial/industrial use that has occurred at the Electrolux site since the facility was built in 1960, on-site workers have been the primary receptors of potential concern. However, in March 2011, Electrolux closed the plant and the site is currently vacant. Also, the manufacturing building is planned for demolition later this year (Golder Associates, 2011). As a result, this assessment will focus only on future exposure pathways.

The Electrolux site is currently zoned as light industrial and is located in close proximity to residential properties and land zoned as a Holding District (Figure 3). According to the Jefferson, Iowa, zoning regulations, permitted uses in the Holding District include: a) agriculture, including farm dwellings, b) home occupations, and c) agricultural services (City of Jefferson Zoning Regulations, 2010). Although it would take a change in zoning classification, based on the proximity of the Electrolux site to residential properties and the Holding District and the uncertainties regarding future land uses (i.e., the site is currently vacant and the current building is planned to be demolished later this year) and potential redevelopment, we assumed that the site could be used for residential purposes in the future.

Future residents may have direct contact with the surface soil. If residential development of the site occurs, the current surface soil and subsurface soil will likely be mixed together during the associated excavation activities. As a result, the future surface soil would be a combination of the current surface soil and current subsurface soil. Direct contact with surface soil could lead to incidental ingestion of contaminants and absorption of contaminants through dermal contact. Fugitive dusts from surface soil could be generated by wind or site activities and subsequently be inhaled by the resident. Also, volatile contaminants can be emitted from soils and be inhaled by the resident. It is also assumed that future residents will install potable water wells into the shallow groundwater. Thus, the future resident may be exposed to chemicals in the groundwater via ingestion, dermal contact while showering, and inhalation of the VOCs while showering and during other activities involving the use of tapwater (e.g., cooking, dishwashing, etc.). In addition, the resident may be exposed to the VOCs that migrate from the groundwater and/or subsurface soil into the house via the vapor intrusion pathway. A discussion regarding the vapor intrusion into indoor air pathway is provided in the uncertainties section.

If land use remains industrial, then future industrial/commercial workers will be the primary receptors of potential concern. Industrial/commercial workers are assumed to have direct contact with surface soil or indoor dust as part of their normal workdays. As previously described for the residential scenario, if development occurs at the site, the current surface soil and subsurface soil will likely be mixed together during the excavation activities. As a result, we assume that industrial/commercial workers will have direct contact with surface soil that could lead to incidental ingestion of contaminants and absorption of contaminants through dermal contact. Industrial/commercial workers may also inhale fugitive dusts generated by wind or site activities.

There is also the potential for construction, landscaping, and utility work to occur in this area. Construction and utility workers could come into contact with contaminated subsurface soils during excavation or by working in trenches while repairing or installing utility lines, and landscape workers could come into contact with subsurface soils during landscaping activities that require digging beyond 2 feet bgs. If the site is disturbed as part of future construction activities, construction workers may be exposed to surface and subsurface soils. It is assumed that construction workers will come into direct contact with soils down to a depth of 10 feet bgs with a bulk of their exposures to subsurface soil during excavation. Direct contact with the soil could lead to incidental ingestion of contaminants and absorption of contaminants through dermal contact. Fugitive dusts from excavated soils could be generated by wind and/or equipment and subsequently be inhaled by a worker. The VOCs within the subsurface soil may volatilize as the soils are exposed to the air and these volatile emissions may be inhaled by the construction worker. Also, because the depth to groundwater ranges from 1.1 to 8.3 feet bgs at the site, an excavation for a building foundation may intersect the water table. In this situation, a construction worker may be exposed directly to the groundwater. It is also possible that the VOCs present in the groundwater may volatilize into the excavation and then be inhaled by a construction worker. Only the construction worker scenario will be evaluated in this assessment because construction workers are expected to account for the risks to both the utility and landscape workers (i.e., construction workers are expected to have a longer exposure frequency and exposure duration).

Risk-Based Screening

In the next step of this screening level assessment, contaminant concentrations in soil and groundwater are compared to risk-based screening levels applicable to the residential and construction worker exposure scenarios. Cancer screening levels are based on a target cancer risk level of 1E-06 and non-cancer screening levels are based on a HI of 1.

Soil (Residential Scenario)

For the residential exposure scenario, contaminant concentrations in soil, not including the TPH-gasoline and the TEH, are compared to residential soil RSLs (see Table 3). Because the RSL table does not currently provide the RSLs for the TPH-gasoline or the TEH, concentrations of these contaminants in soil are compared to preliminary remediation goals (PRGs) calculated by the EPA Region 7 for the diesel range organic fraction of the TPH (Table 3; USEPA, 2011b).

The maximum concentration of trichloroethylene (TCE) in soil exceeds its carcinogenic screening level (1E-06) and the non-cancer screening level (HI=1), but is less than the carcinogenic RSL corresponding to a cancer risk of 1E-04. Also, the maximum soil concentrations of 1,1,2,2-tetrachloroethane and 1,2,3-trichloropropane exceed their respective carcinogenic screening levels (1E-06), but are below the non-cancer screening levels (HI=1). The maximum detections of these contaminants are less than the carcinogenic RSL corresponding to a cancer risk of 1E-05.

The maximum concentration of the TEH exceeds the non-cancer screening level, but the TPH-gasoline does not exceed the non-cancer screening level (see Table 3). The results for the TPH-gasoline and the TEH are both included in this screening level assessment because two different analytical methods were used by the State Hygienic Laboratory at the University of Iowa. The TPH-gasoline was analyzed by Method OA-1, which is used to determine the concentration of volatile petroleum hydrocarbons and other individual components such as benzene, toluene, ethyl benzene, and xylenes. The TEH was analyzed by Method OA-2, which covers the determination of low volatility petroleum products and organic compounds.

Table 3. Comparison of Soil Sample Results to RSLs for Residential Soil (Concentrations in mg/kg)

Chemical	Maximum Concentration[1]	Carcinogenic Soil Screening Level (1E-06)	Non-Cancer Soil Screening Level (HI=1)
1,1,2,2-Tetrachloroethane	1.64	0.56[2]	1,600[2]
1,2,3-Trichloropropane	0.0978	0.005[2]	5.2[2]
1,2,4-Trimethylbenzene	14.6	---	62[2]
Tetrachloroethylene	0.214	0.55	370[2]
Trichloroethylene	159	2.8[2]	25[2]
TPH-Gasoline[4]	181	---	797[3]
Total Extractable Petroleum Hydrocarbons[5]	19,700	---	797[3]

[1]Maximum concentration of chemical detected in subsurface soil samples (2-10 feet bgs).
[2]Residential Soil RSLs obtained from the EPA's RSL Table (USEPA, 2011a).
[3]Residential Soil Screening value obtained from "PRGs for the Diesel Range Organic Fraction of the TPH" memo (USEPA, 2011b).
[4]Iowa OA-1 Analytical Method.
[5]Iowa OA-2 Analytical Method.

Soil (Industrial and Construction Worker)

The industrial and construction worker scenarios are evaluated using the industrial soil RSLs. Because construction worker soil RSLs are not available, industrial soil RSLs are used as surrogate screening levels (see Table 4). Also, the RSL table does not currently provide the RSLs for the TPH-gasoline or the TEH. Therefore, concentrations of these contaminants in soil are compared to PRGs calculated for industrial and construction workers by the EPA Region 7 for the diesel range organic fraction of the TPH (USEPA, 2011b).

The maximum soil concentration of the TCE exceeds its carcinogenic industrial soil screening risk level and the non-cancer screening level. The maximum detection of the TCE falls in between carcinogenic screening levels corresponding to 1E-05 and 1E-04. Also, the maximum concentrations of 1,1,2,2-tetrachloroethane and 1,2,3-trichloropropane fall below their respective non-cancer screening levels and are slightly above or below their carcinogenic screening levels (1E-06).

The maximum concentration of the TEH exceeds the non-cancer screening levels for the industrial and construction worker scenarios, but the TPH-gasoline does not exceed the non-cancer screening level(see Table 4).

Table 4. Comparison of Soil Sample Results to Screening Levels for Industrial and Construction Workers (mg/kg)

Chemical	Maximum Concentration[1]	Carcinogenic Soil Screening Level (1E-06)	Non-Cancer Soil Screening Level (HI=1)
1,1,2,2-Tetrachloroethane	1.640	2.8[2]	20,000[2]
1,2,3-Trichloropropane	0.0978	0.095[2]	22[2]
1,2,4-Trimethylbenzene	14.6	---	260[2]
Tetrachloroethylene	0.214	2.6	2,300[2]
Trichloroethylene	159	14[2]	100[2]
TPH-Gasoline[5]	181	--- ---	362[3] 3,717[4]
Total Extractable Petroleum Hydrocarbons[6]	19,700	--- ---	362[3] 3,717[4]

[1]Maximum concentration of chemical detected in subsurface soil samples (2-10 feet bgs).
[2]Industrial Soil RSLs obtained from the EPA's RSL Table (USEPA, 2011a) are used as a surrogate for the construction worker scenario.
[3]Construction Worker Soil Screening value obtained from "PRGs for the Diesel Range Organic Fraction of TPH" memo (USEPA, 2011b).
[4] Industrial Worker Soil Screening value obtained for "PRGs for the Diesel Range Organic Fraction of TPH" memo (USEPA, 2011b).
[5]Iowa OA-1 Analytical Method.
[6]Iowa OA-2 Analytical Method.

Groundwater (Residential Tapwater)

For the residential exposure scenario, contaminant concentrations in groundwater, not including the TEH, are compared to tapwater RSLs (Table 5). Because the RSL table does not currently provide the RSLs for the TEH, the TEH concentrations in groundwater are compared to the PRGs calculated by the EPA Region 7 for the TPH-gasoline and the TPH-diesel (USEPA, 2011b).

The maximum groundwater detections for all chemicals listed in Table 5 that have carcinogenic tapwater RSLs, exceed their respective carcinogenic screening levels (1E-06). Of these chemicals, 1,1,2-trichloroethane, 1,1-dichloroethane, naphthalene, tetrachloroethylene (PCE), the TCE, and vinyl chloride exceed their respective carcinogenic RSL corresponding to a cancer risk of 1E-04. In addition, 1,1,2-trichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, *cis*-1,2-dichloroethylene, naphthalene, the PCE, the TCE, xylenes, and the TEH exceed the non-cancer screening level (HI=1).

Maximum groundwater concentrations were also compared to the federal drinking water standards or maximum contaminant levels (MCLs). For those chemicals in which an the MCL has been promulgated, maximum detected concentrations of 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethylene, 1,2-dichloroethane, *cis*-1,2-dichloroethylene, the PCE, the TCE, and vinyl chloride exceed their respective MCL (Table 5).

Table 5. Comparison of Groundwater Sample Results to RSL for Tapwater (µg/L)

Chemical	Maximum Concentration	Carcinogenic Tapwater Screening Level (1E-06)	Non-Cancer Tapwater Screening Level (HI=1)	MCL
1,1,1-Trichloroethane	4,590	NA	9,100	200
1,1,2-Trichloroethane	35.1	0.24	0.42	5.0
1,1-Dichloroethane	292	2.4	7,300	NA
1,1-Dichloroethylene	3,750	NA	340	7.0
1,2,4-Trimethylbenzene	285	NA	15	NA
1,2-Dichloroethane	8.91	0.15	14	5.0
1,3,5-Trimethylbenzene	104	NA	370	NA
Benzene	1.76	0.41	44	5.0
Chloroform	4.03	0.19	130	80
cis-1,2-Dichloroethylene	120	NA	73	70
Ethylbenzene	33.0	1.5	1,300	700
Naphthalene	38.4	0.14	6.2	NA
Tetrachloroethylene	548	0.11	220	5.0
Trichloroethylene	189,000	2.0	21	5.0
Vinyl chloride	3.64	0.016	72	2.0
Xylenes	226	NA	200	10,000
Total Extractable Petroleum Hydrocarbons (TEH)	119,000	---	209[1]	NA

[1]Residential Groundwater Screening value obtained from "PRGs for the Diesel Range Organic Fraction of TPH" memo (USEPA, 2011b).

Groundwater (Construction Worker)

For the construction worker exposure scenario, contaminant concentrations in groundwater, not including the TEH, are compared to the Virginia Department of Environmental Quality (VDEQ) groundwater screening levels for construction/utility workers in a trench: groundwater less than 15 feet deep (VDEQ, 2010). The VDEQ screening levels were adjusted from a non-cancer target hazard quotient (HQ) of 0.1 to an HQ of 1. Subchronic screening levels for the TPH gasoline and the TPH-diesel were derived using the VDEQ construction worker in a trench, shallow groundwater, model. Additional information on the derivation of these values including equations and exposure factors is provided in Attachment 1.

The maximum groundwater concentration of the TCE detected at the Electrolux site exceeds both the carcinogenic and non-cancer screening levels. The maximum detection of the TCE also exceeds the carcinogenic screening level corresponding to a cancer risk of 1E-04. Maximum concentrations of 1,1,2-trichloroethane, 1,1-dichloroethane, 1,2,-dichloroethane, naphthalene, and PCE also exceed the carcinogenic screening level, but fall below screening levels corresponding to a 1E-04 or 1E-05 cancer risk level. Also, the maximum concentrations of 1,1-dichloroethylene, 1,2,4-trimethylbenzene, naphthalene, and the TEH exceed their non-cancer screening levels.

Table 6. Comparison of Groundwater Sample Results to Screening Levels for Construction Worker in a Trench (μg/L)

Chemical	Maximum Concentration	Carcinogenic Screening Level (1E-06)	Screening Level (HQ=1)
1,1,1-Trichloroethane	4,590	NA	12,100
1,1,2-Trichloroethane	35.1	11.2	64,100
1,1-Dichloroethane	292	91.8	10,500
1,1-Dichloroethylene	3,750	NA	411
1,2,4-Trimethylbenzene	285	337	162
1,2-Dichloroethane	8.91	5.94	5,420
1,3,5-Trimethylbenzene	104	NA	2,250
Benzene	1.76	16.6	55.3
Chloroform	4.03	7.07	225
cis-1,2-Dichloroethylene	120	NA	149,000
Ethylbenzene	33.0	59.0	2,020
Naphthalene	38.4	5.46	7.95
Tetrachloroethylene	548	18.4	599
Trichloroethylene	189,000	84.0	1,450
Vinyl chloride	3.64	23.3	162
Xylenes	226	NA	218
Total Extractable Petroleum Hydrocarbons	119,000	---	239 – TPH-Gasoline[1] 2,650 – TPH-Diesel[1]

[1]Calculated as described in Attachment 1.

Uncertainties Analysis

Several uncertainties have been identified during this screening level evaluation. First, the sample collection scheme was not designed for evaluating potential human health risks, but rather to determine whether or not contamination had migrated off-site. For example, substantial contamination was found in soil and groundwater samples collected adjacent to the south and southeastern side of the on-site building; however, contamination directly underneath the building is unknown because no samples were collected.

In addition, the evaluation of petroleum hydrocarbons is difficult because petroleum products are a complex and highly variable mixture of hundreds of individual hydrocarbon compounds. The Regional Screening Levels Table does not currently provide the RSLs for petroleum hydrocarbons or any fractions of petroleum hydrocarbons. Therefore, Region 7 has developed site-specific Diesel Range Organics and Gasoline Range Organics PRGs for soils and groundwater. These PRGs only account for the non-cancer effects; cancer effects need to be evaluated separately by the identification and quantitation of those specific hydrocarbon compounds, such as benzene and certain polycyclic aromatic hydrocarbons (PAHs), which are designated carcinogens. Although benzene was evaluated separately in this evaluation, the PAHs could not be evaluated because they were not analyzed for at this site.

Although not evaluated in this assessment, the vapor intrusion into indoor air pathway is another source of uncertainty under current and future conditions. Conditions may arise or already exist making it possible for subsurface vapors to impact indoor air. These conditions include significant preferential pathways such as utility conduits, fractures, and other naturally-occurring and anthropogenic features that intersect vapor sources (USEPA, 2002).

Another area of uncertainty is the effect that demolition of the current building may have on the movement of the contamination. It is possible that demolition of the building will expose the contamination and have a significant impact on leaching rates and movement of the contamination, especially in groundwater.

In addition to the uncertainties discussed above, we conservatively assumed that the site could be used for residential purposes in the future given the uncertainty regarding future land-uses (i.e., the site is currently vacant and the building is scheduled for demolition) and proximity of the site to residences and land being zoned in the Holding District classification. We also assumed that soils at depth could be brought to the surface during redevelopment and that they would not be diluted upon mixing with soils from non-contaminated areas. In addition, maximum detections were assumed to be representative of long-term exposures. In other words, we have assumed that future residents, including children, come into direct contact (i.e., ingestion, dermal contact, and inhalation of particulates and volatiles) with contaminated soil daily for many years. These assumptions are considered "worst-case" and are intended to ensure that potential human health risks are not underestimated and to account for the uncertainties with future land-uses and limitations in the data set.

Lastly, the industrial RSLs for soil were used as a surrogate to evaluate the construction worker scenario. Industrial screening levels are based on chronic rather than subchronic toxicity data. The use of chronic toxicity data to evaluate subchronic exposure likely overestimates health risks. However, subchronic toxicity values are typically no more than an order of magnitude (i.e., 10x) greater than chronic toxicity values.

Conclusions

Levels of contaminants in subsurface soils exceed risk-based screening levels set at a HI of 1 and cancer risk level set at 1E-06. No contaminants were detected at concentrations that exceed screening levels corresponding to a cancer risk level of 1E-04; however, maximum concentrations of the TCE and the TEH detected in subsurface soil exceeded the non-cancer screening level for all scenarios evaluated. Based on this evaluation, the data indicate that subsurface soils may pose significant human health risks to future industrial/commercial workers, construction workers, and residents.

Levels of contaminants in groundwater exceed risk-based screening levels set at a HI of 1 and cancer risk level set at 1E-06. Several contaminants were also determined to exceed screening levels corresponding to a cancer risk level of 1E-04. Based on this evaluation, the data indicate that groundwater may pose significant human health risks to future construction workers and residents. For construction workers, the TCE exceeds screening levels corresponding to a cancer risk level of 1E-04, and 1,2,4-trimethylbenzene, naphthalene, the TCE, xylenes, and the TEH exceed the non-cancer screening levels set at a HI of 1. For future residents, 1,1,2-trichloroethane, 1,1-dichloroethane, naphthalene, the PCE, the TCE, and vinyl chloride exceeded screening levels corresponding to a cancer risk level of 1E-04. Also, 1,1,2-trichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, *cis*-1,2-dichloroethylene, naphthalene, the PCE, the TCE, xylenes, and the TEH exceed the non-cancer screening levels set at a HI of 1.

While the residential screening levels may overestimate human health risks, there are significant uncertainties regarding future activities that may occur at the site, especially considering the site is currently vacant and that the building currently located on the site is schedule for demolition. As stated previously, it is possible that demolition of the building could have a significant impact on leaching rates and movement of the contamination. Also, the vapor intrusion into indoor air pathway is another source of uncertainty in which conditions may arise or already exist that make it possible for subsurface vapors to impact indoor air. Thus, we recommend that this exposure pathway be further evaluated before this property is redeveloped.

References

City of Jefferson. 2010. Iowa. City of Jefferson Zoning Regulations. Chapter 165, Code of Ordinances, Jefferson, Iowa. Available on-line at http://www.cityofjeffersoniowa.org/pdf/Zoning_Regulations.pdf.

Golder Associates. 2011. Letter Report, Former Electrolux Manufacturing Facility, Jefferson, Iowa. Manchester, NH. May 13.

U.S. EPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington D.C. OSWER 9355.4-2.

U.S. EPA. 2011a. Regional Screening Level Table. June 2011. Available on-line at http://www.epa.gov/region09/superfund/prg/.

U.S. EPA. 2011b. "PRGs for the Diesel Range Organic Fraction of TPH." Memo from Jeremy Johnson to Jim Aycock, Region 7, Kansas City, KS. June 10.

Virginia Department of Environmental Quality (VDEQ). 2010. Table 6.4 Construction Trench: Contact with Groundwater. November 2010. Available on-line at http://www.deq.state.va.us/vrprisk/tables.html.

Attachment 1

Derivation of Subchronic Groundwater Screening Values for TPH-Gasoline and TPH-Diesel for the Electrolux Home Products, Inc. Site, Jefferson, Iowa

The Virginia Department of Environmental Quality (VDEQ) shallow groundwater trench model was used to develop subchronic screening levels for the trench model. Specifically, the vrp64.xls spreadsheet was used to derive the screening levels (VDEQ, 2010). The spreadsheet was modified by eliminating all other chemicals and adding the aliphatic and aromatic fractions having toxicity values. Dermal contact and ingestion are not risk driving routes of exposure; therefore, the worksheets covering these routes of exposure were eliminated. For chemical properties, nonane was used as a surrogate for C9-C18 aliphatics and naphthalene was used as the surrogate for C9-C16 aromatics. Default exposure parameters used by VDEQ were used in these calculations (Exhibit 1). The subchronic RfCs used in previous PRG calculations were used to calculate these screening levels (USEPA, 2011b).

The screening levels were calculated to be (Exhibit 2):

Aliphatic - 24 µg/L (HQ = 0.1)
Aromatic - 265 µg/L (HQ = 0.1)

Exhibit 1. Setting used in calculation of screening level values.

For Mass-Transfer Coefficients:

Kg,H2O	0.833	cm/s
MWH2O	18	
Kg,O2	0.002	cm/s
MWO2	32	
T	**77**	F
T	298	K
R	8.20E-05	atm-m3/mol-K

For Emission Flux and Concentration in Trench:

CF1	1.00E-03	L/cm3
CF2	1.00E+04	cm2/m2
CF3	3600	s/hr
F	**1**	
ACH	2	hr-1

Trench dimensions:

Length	**8**	ft
	2.44	m
Width	**3**	ft
	0.91	m
Depth	**8**	ft
	2.44	m
Width/Depth	0.38	

Inhalation Exposure Factors:

ET	0.17	4hrs/24hrs
EF	125	days/year
ED	1	year
BW	70	kg
AT-C	25550	days/year
AT-N	365	days/year

Oral Exposure Factors:

IR-W	0.02	L/day
CF	1000	ug/mg
EF	125	days/year
ED	1	years
BW	70	kg
AT-C	25550	days
AT-N	365	days

Dermal Exposure Factors:

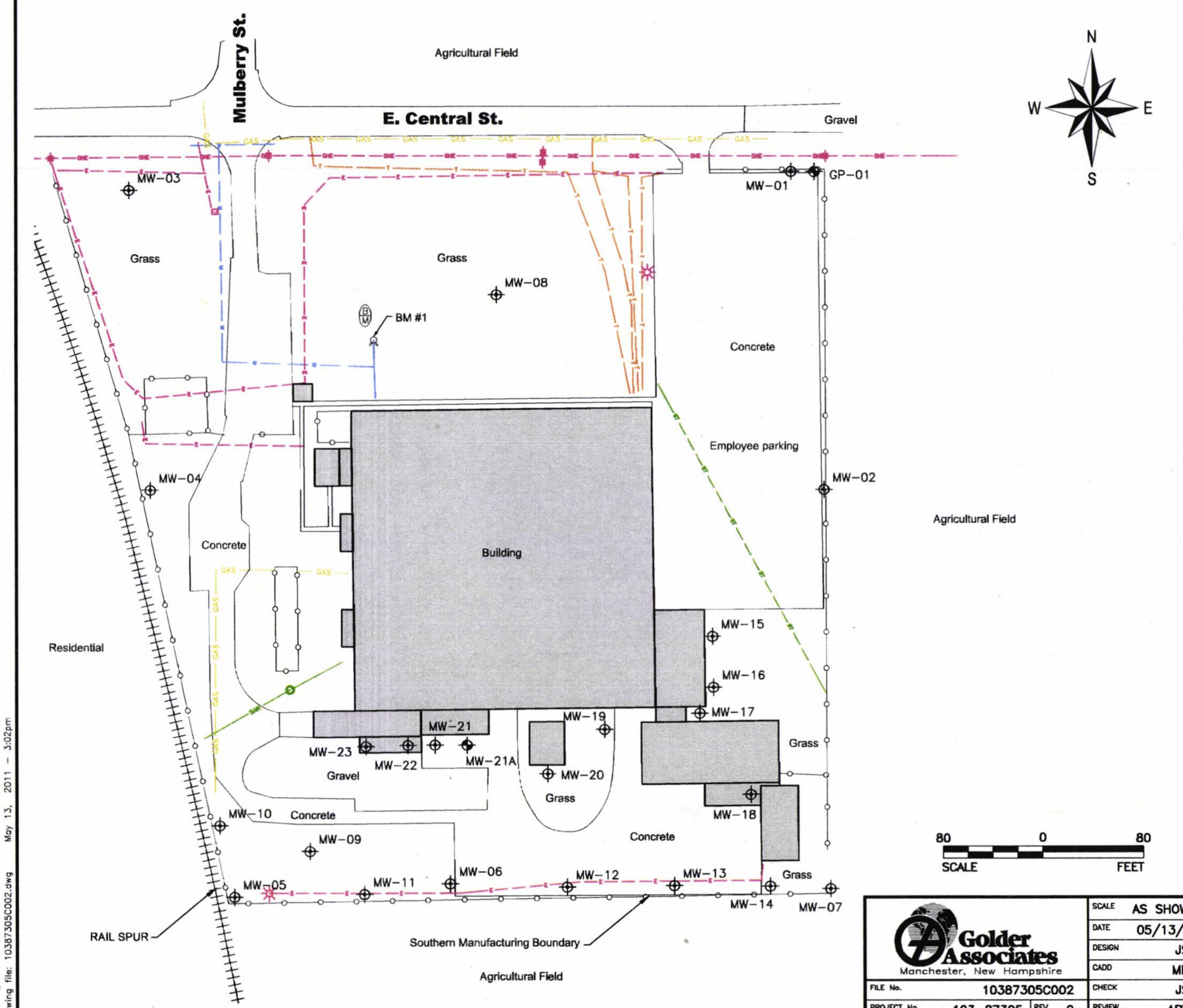
EV	1	events/day
EF	125	days/years
ET	4	hours/day
ED	1	years
SA	3300	cm2
CF1	1000	cm3/L
CF2	0.001	mg/ug
BWa	70	kg
AT-C	25550	days
AT-N	365	days

Target Risk and Hazard Quotient:

TR	1.00E-06	
THQ	0.1	

Exhibit 2. The modified vrp64.xls spreadsheet used to derive the C9-C18 aliphatic and C9-C16 aromatics screening levels (VDEQ, 2010).

Revised 11/17/10 Groundwater Screening Levels (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Inhalation Unit Risk Factor URF 1/(mg/m3)	Inhalation Reference Concentration RfCi mg/m3	Screening Level Air Cancer ASL-c ug/m3	Screening Level Air Noncancer ASL-nc ug/m3	Screening Level Air in Trench ASL ug/m3	Volatilization Factor VF L/m3	Screening Level Groundwater GSL ug/L
TCL Volatile Organic Compounds (VOCs)												
TPH - Gasoline C9-C18 aliphatic (Nonane)	130.00	3.84E+00	4.30E-01	9.92E-04	9.92E-04		1.00E-01		1.75E+02	1.75E+02	7.32E+00	2.39E+01
TPH - Diesel (Volatile Fraction) C9-C16 aromatics (naphthalene)	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04		1.00E+00		1.75E+03	1.75E+03	6.60E+00	2.65E+02
(Surrogate Compound for Chemical Properties)												



LEGEND

- Groundwater Elevation contour (NGVD 88)
- Fence
- Edge gravel
- MW-01 Monitoring well location
- GP-01 Boring location
- Building
- Bench mark
- Telephone line
- Water line
- Overhead electrical line
- Electrical line
- Gas line
- Sanitation line
- Storm drain line
- Building

NOTES

1.) BM #1 elev. = 1052.49 (NAVD 88) center top non-operating bolt on fire hydrant Northwest of main building.

2.) JEO consulting group did not find useful NGS monuments in the Jefferson area. A USGS 24,000k Topographic map elevation (1054.00) at the intersection of Mulberry Street and East Central Street as the assumed NAVD 88 elevation. This elevation agreed with the elevation generated from Geoid-09.

3.) The coordinates for this site are approximate Iowa State Plane North 1401 with a ground scale factor of 1.0000463418.

REFERENCES

1.) Basemap taken from JEO Consulting Group, Inc. drawing titled, "Electrolux Home Products base map", dated 11/21/10.

FIGURE NARRATIVE

This figure shows the site building, boring, and monitoring well locations at the Jefferson site.

Golder Associates, Manchester, New Hampshire		SCALE	AS SHOWN
		DATE	05/13/11
		DESIGN	JSP
		CADD	MPB
FILE No.	10387305C002	CHECK	JSP
PROJECT No.	103-87305 REV. 0	REVIEW	APTM

TITLE

Figure 1. Site Map

ELECTROLUX / JEFFERSON, IOWA

Drawing file: 10387305C002.dwg May 13, 2011 - 3:02pm

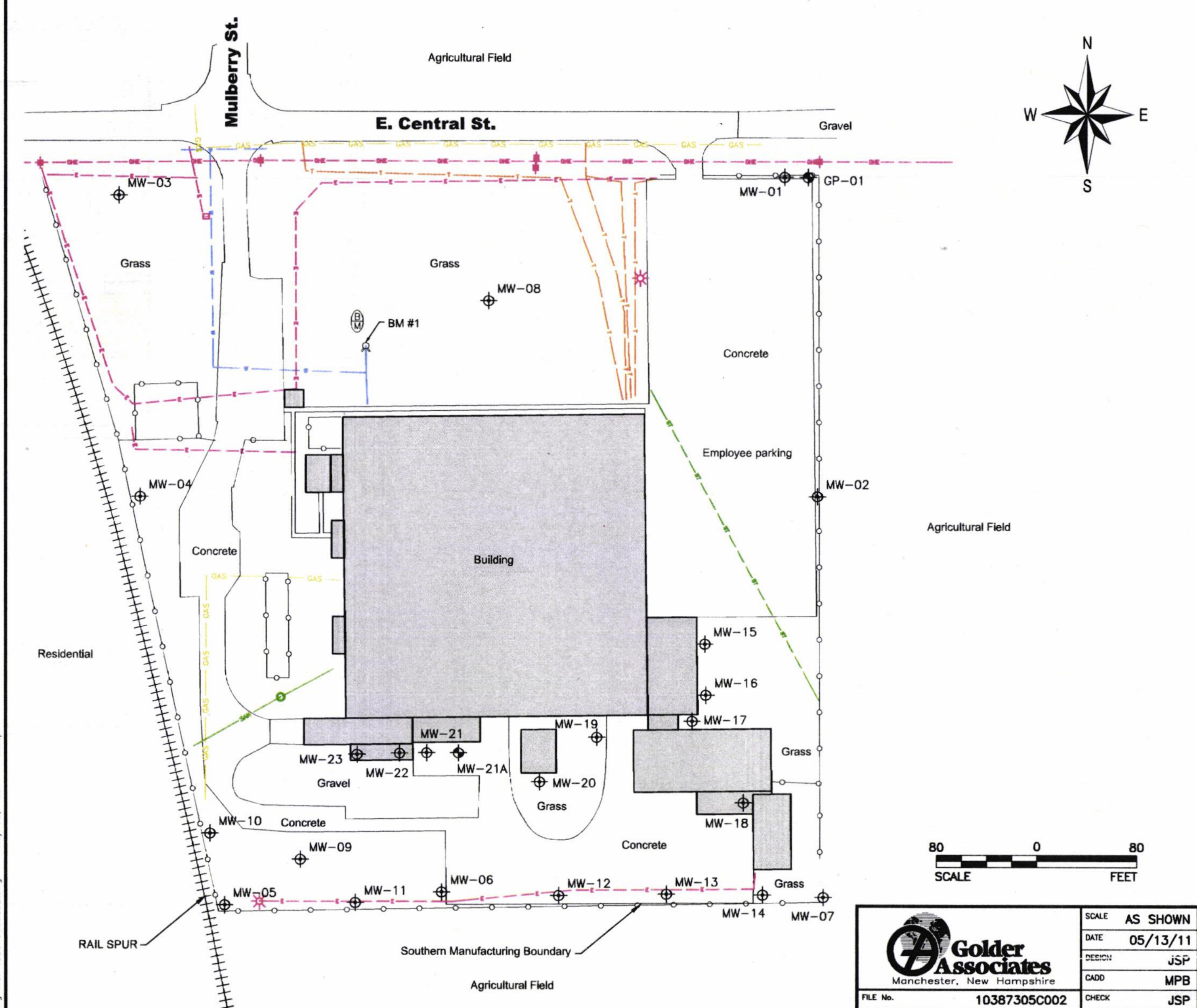


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FIGURE NARRATIVE

This figure shows the site building, boring, and monitoring well locations at the Jefferson site.

Golder Associates
Manchester, New Hampshire

SCALE	AS SHOWN	TITLE	
DATE	05/13/11		Figure 2. Locations of soil borings and well locations.
DESIGN	JSP		
CADD	MPB		
FILE No. 10387305C002	CHECK	JSP	
PROJECT No. 103-87305 REV. 0	REVIEW	APTM	ELECTROLUX / JEFFERSON, IOWA

Drawing file: 10387305C002.dwg May 13, 2011 - 3:02pm

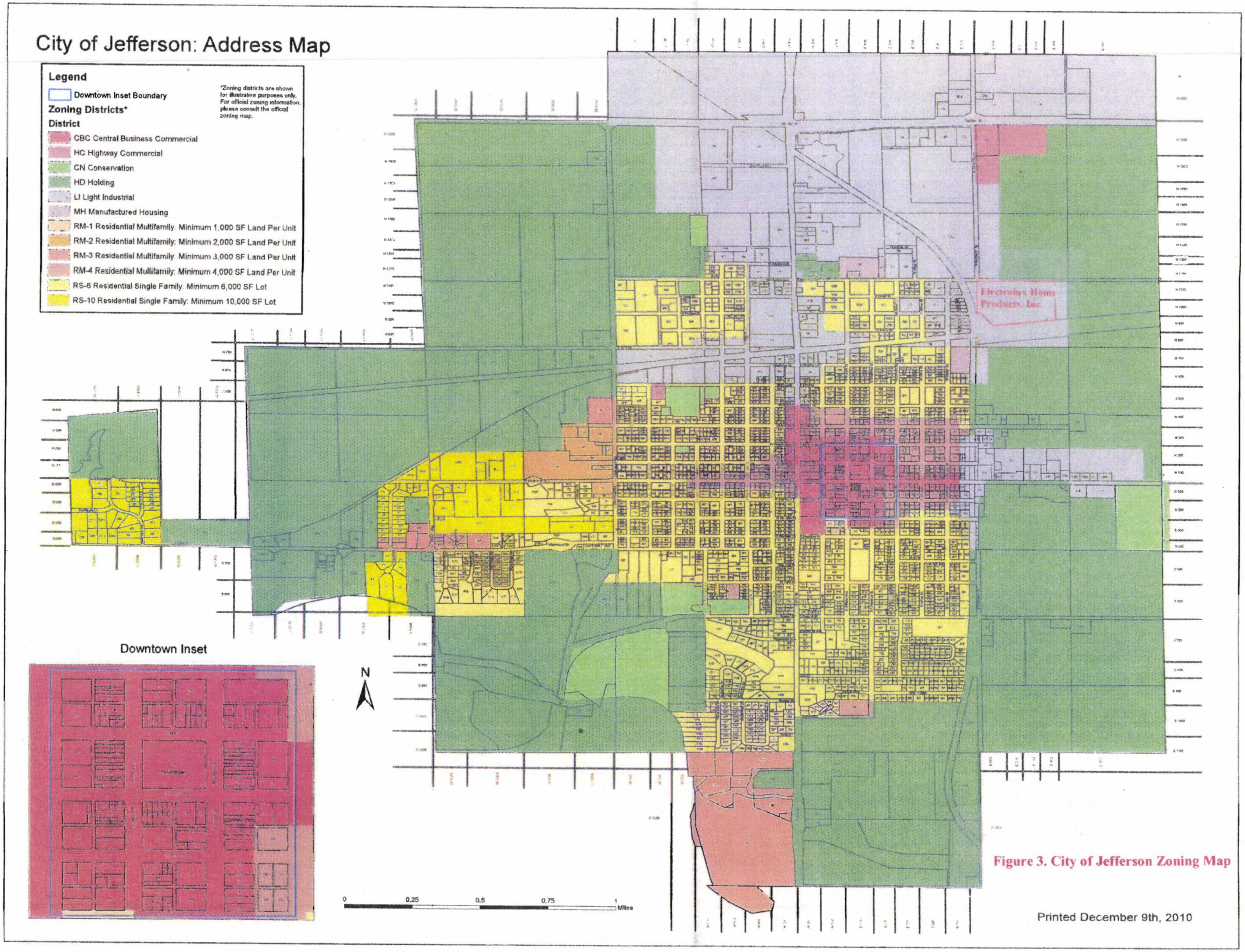

Figure 3. City of Jefferson Zoning Map